

## ARTIFACT SHEET

Enter artifact number below. Artifact number is application number + artifact type code (see list below) + sequential letter (A, B, C . . ). The first artifact folder for an artifact type receives the letter A, the second B, etc..  
Examples: 59123456PA, 59123456PB, 59123456ZA, 59123456ZB

09-659-375 BA

Indicate quantity of a single type of artifact received but not scanned. Create individual artifact folder/box and artifact number for each Artifact Type.

☐

CD(s) containing:

computer program listing

Doc Code: Computer

pages of specification

and/or sequence listing

and/or table

Doc Code: Artifact

content unspecified or combined

Doc Code: Artifact

☐

Artifact Type Code: P

☐

Artifact Type Code: S

☐

Artifact Type Code: U

☐

Stapled Set(s) Color Documents or B/W Photographs

Doc Code: Artifact      Artifact Type Code: C

☐

Microfilm(s)

Doc Code: Artifact      Artifact Type Code: F

☐

Video tape(s)

Doc Code: Artifact      Artifact Type Code: V

☐

Model(s)

Doc Code: Artifact      Artifact Type Code: M

☒

Bound Document(s)

Doc Code: Artifact      Artifact Type Code: B

☐

Confidential Information Disclosure Statement or Other Documents marked Proprietary, Trade Secrets, Subject to Protective Order, Material Submitted under MPEP 724.02, etc.

Doc Code: Artifact      Artifact Type Code X

☐

Other, description: \_\_\_\_\_

Doc Code: Artifact      Artifact Type Code: Z



US005805334A

# United States Patent [19] Takahashi

[11] Patent Number: 5,805,334  
[45] Date of Patent: Sep. 8, 1998

## [54] CATADIOPTIC PROJECTION SYSTEMS

[75] Inventor: Tomowaki Takahashi, Yokohama, Japan

[73] Assignee: Nikon Corporation, Tokyo, Japan

[21] Appl. No.: 858,560

[22] Filed: May 19, 1997

## [30] Foreign Application Priority Data

May 20, 1996 [JP] Japan ..... 8-149903

[51] Int. Cl.<sup>6</sup> ..... G02B 17/08; G03B 27/42

[52] U.S. Cl. .... 359/364; 359/727; 359/732; 359/784

[58] Field of Search ..... 359/364, 365, 359/366, 727, 728, 732, 784

## [56] References Cited

### U.S. PATENT DOCUMENTS

4,779,966 10/1988 Friedman .  
5,089,913 2/1992 Singh et al. .  
5,592,329 1/1997 Ishiyama et al. .... 359/727  
5,668,673 9/1997 Suenaga et al. .... 359/727  
5,689,377 11/1997 Takahashi ..... 359/727  
5,691,802 11/1997 Takahashi ..... 359/727  
5,694,241 12/1997 Ishiyama et al. .... 359/727

### FOREIGN PATENT DOCUMENTS

61-156737 7/1986 Japan .

63-163319 7/1988 Japan .  
2-66510 3/1990 Japan .  
3-282527 12/1991 Japan .  
4-234722 8/1992 Japan .  
5-72478 3/1993 Japan .

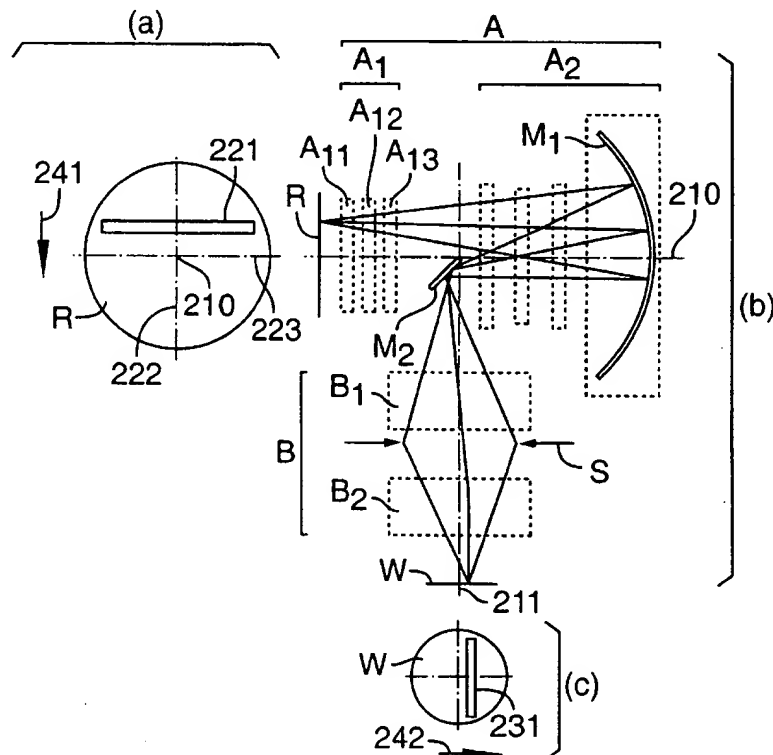
Primary Examiner—Jon W. Henry

Attorney, Agent, or Firm—Klarquist Sparkman Campbell Leigh & Winston, LLP

## [57] ABSTRACT

Catadioptric projection systems are disclosed for projecting an illuminated region of a reticle onto a corresponding region on a substrate. The systems are preferably used with ultraviolet light sources (e.g., 193 nm). The systems comprise a first imaging system, a concave mirror, and a second imaging system. The first imaging system comprises a single-pass lens group and a double-pass lens group. The single-pass lens group comprises a first negative subgroup, a positive subgroup, and a second negative subgroup. Light from the illuminated region of the reticle passes through the single-pass lens group and the double-pass lens group, and reflects from the concave mirror to pass back through the double-pass lens group to form an intermediate image of the illuminated region of the reticle. The light is then directed to the second imaging system that re-images the illuminated region of the reticle on the substrate. Alternatively, light from the single-pass lens group is reflected by a turning mirror to the double-pass lens group, wherein the light returning through the double-pass lens group continues directly to the second imaging system.

26 Claims, 5 Drawing Sheets



# The United States of America



## The Commissioner of Patents and Trademarks

*Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.*

*Therefore, this*

### United States Patent

*Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America for the term set forth below, subject to the payment of maintenance fees as provided by law.*

*If this application was filed prior to June 8, 1995, the term of this patent is the longer of seventeen years from the date of grant of this patent or twenty years from the earliest effective U.S. filing date of the application, subject to any statutory extension.*

*If this application was filed on or after June 8, 1995, the term of this patent is twenty years from the U.S. filing date, subject to any statutory extension. If the application contains a specific reference to an earlier filed application or applications under 35 U.S.C. 120, 121 or 365(c), the term of the patent is twenty years from the date on which the earliest application was filed, subject to any statutory extension.*

*Bence Lehman*

Commissioner of Patents and Trademarks

*Ellie M. Person*  
Attest